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Nishi et al.

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[54] **ILLUMINATION OPTICAL APPARATUS USING DIFFERENT NUMBER OF LIGHT SOURCES UNDER DIFFERENT EXPOSURE MODES, METHOD OF OPERATING AND METHOD OF MANUFACTURING THEREOF**

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Related U.S. Application Data

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **355/70**; 355/67; 355/69; 359/619

[58] **Field of Search** 355/67, 69, 70; 359/619

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[57] **ABSTRACT**

A diffraction grating is set between a light source and a fly-eye lens composed of a plurality of lens elements rectangular in cross section, and using the zeroth order diffraction beam and ±first order diffraction beams emergent from the diffraction grating, a plurality of light source images are formed along the longitudinal direction on the exit plane of each lens element in the fly-eye lens. In a preferred mode the intensity of illumination light on a mask is increased using first and second light sources, and first illumination beam, which is obtained by combining a beam emitted from the first light source and passing through a half prism with a beam emitted from the second light source and reflected by the half prism on a same axis, and a second illumination beam, which is obtained by combining a beam emitted from the first light source and reflected by the half prism with a beam emitted from the second light source and passing through the half prism on a same axis, are made incident into the fly-eye lens as being inclined symmetrically with each other with respect to the optical axis of illumination optical system.

31 Claims, 12 Drawing Sheets